If you are using a printed copy of this procedure, and not the on-screen version, then you MUST make sure the dates at the bottom of the printed copy and the on-screen version match.
The on-screen version of the Collider-Accelerator Department Procedure is the Official Version.
Hard copies of all signed, official, C-A Operating Procedures are kept on file in the C-A ESHQ Training Office, Bldg. 911A.

C-A OPERATIONS PROCEDURES MANUAL

2.6.10 Lockout/Tagout Procedure for RHIC Main Power Supplies

Text Pages 2 through 9

Hand Processed Changes

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Approved: ***Signature on File*** _____
Collider-Accelerator Department Chairman Date

C. Schultheiss

2.6.10 Lockout/Tagout Procedure for RHIC Main Power Supplies

1. Purpose

1.1 The purpose of this procedure is to provide instructions in how to perform the Lockout/Tagout (LOTO) of the RHIC Main Power Supplies (MPS).

- Refer to section 5.2 for LOTO for access to MPS 480 VAC input enclosure, or SCR enclosure.
- Refer to section 5.4 for LOTO for access to OCC.
- Refer to section 5.6 for LOTO for access to a ring, a valve box, or other power supplies on the main power supply circuit.

1.2 There are four Main Power Supplies: one for the Yellow Quad Ring, one for the Yellow Dipole Ring, one for the Blue Quad Ring, and one for the Blue Dipole Ring. Each MPS has one Flat-Top Power Module (FTPM), one Ramp Power Module (RPM), one Output Circuit Compartment (OCC), and one Energy Dump Resistor Enclosure (EDRE). The maximum ratings of the MPS are given in Table 1.

Table 1

Maximum Output Ratings for MPS

Power Supply	Voltage	Current
Yellow Quad	90 VDC	5500 ADC
Yellow Dipole	400 VDC	5500 ADC
Blue Quad	90 VDC	5500 ADC
Blue Dipole	400 VDC	5500 ADC

1.3 All the MPS are located in service building 1004B.

1.4 This procedure is to be performed only by persons qualified, as described in Paragraph 2.

2. Responsibilities

The list of persons authorized to perform these steps, and documentation of the requisite training and credentials, will be maintained by the Power Supply Systems Section Head, and reviewed at least annually. Updates will be sent to the Project Safety Coordinator. A copy of this list will be posted in Building 1004B.

3. Prerequisites

3.1 Personnel performing this procedure shall be authorized by the Power Supply Systems Section Head. The authorization shall be renewed yearly, and anytime the Power Supply Systems Section Head sees the need.

3.2 Only persons with current training in BOTH general LOTO procedures, and LOTO procedures *specific* to the MPS, will be qualified to perform the steps in this procedure.

3.3 All authorized personnel shall be trained on electrical safety specific to the task(s) to be performed, and training documentation shall be kept. This shall include:

- Classroom training - this may be supplemented by video presentation.
- "Hands-on" training - on the proper procedure for LOTO of the substation breakers.

4. Precautions

Warning:
Strict compliance with this procedure and the BNL ES&H Standard 1.5.1 is necessary to avoid fatal or serious injuries to personnel.

Note:
Do not attempt to unlock or open any panels in the substation enclosure.

4.1 Notification

Notify affected personnel of the action to be taken, in accordance with BNL LOTO policy (ES&H 1.5.1).

5. Procedure

5.1 Companion Documents

5.1.1 These procedures are ONLY to be performed by authorized personnel as defined in Section 2.2, and only with the MPS in a state where LOTO can be safely performed, as indicated by the current operational procedure for the MPS. This will shut down the equipment before the LOTO procedure commences.

5.1.2 The requirements of BNL ES&H STANDARD 1.5.1 Logout/Tagout Requirements shall be followed.

5.2 Performing LOTO on Substation

This section must be performed before access to the 480 VAC input enclosure, and/or the SCR enclosure of the power modules is permitted. This shuts off the 480 VAC input to the power modules.

These steps must be performed on BOTH the flattop power module, and the ramp power module that form a power supply.

5.2.1 Circuit Breaker Preparation

5.2.1.1 Obtain key to substation gate.

i. The key will be kept by the Technical Supervisor of the Power Supply Systems Section. A duplicate key will be kept by the Project Safety Coordinator

ii. The 'Safety Watch' rule applies in this procedure. One authorized person performs the procedure, and a second authorized person observes the procedure through the open door from outside the enclosure. The 'Safety Watch' is responsible for keeping unauthorized individuals out of the flash boundary.

iii. Approved flash suit, and other personal protection equipment, must be worn by the authorized person affecting LOTO during the racking out procedure.

5.2.1.2 Identify breaker to be locked out.

Warning:
Only breakers labeled for RHIC access are to be operated. Access to all other breakers is strictly forbidden.

Each Power Module has its own dedicated circuit breaker. Table 2 lists the power modules, the circuit breaker nomenclature, and the Kirk Key numbers associated with each power module.

Table 2

Circuit Breaker Nomenclature for the Power Modules

POWER MODULE	CIRCUIT BREAKER	KIRK KEY NUMBER
Yellow Quad Ramp	YQRP-Quadrupole Feeder 52-116	18038
Yellow Quad Flattop	YQFTP-Quadrupole Feeder 52-114	18039
Yellow Dipole Ramp	YDRP-Dipole Feeder 52-117	18036
Yellow Dipole Flattop	YDFTP-Dipole Feeder 52-115	18037
Blue Quad Ramp	BQRP-Quadrupole Feeder 52-212	18034
Blue Quad Flattop	BQFTP-Quadrupole Feeder 52-214	18035
Blue Dipole Ramp	BDRP-Dipole Feeder 52-211	18032
Blue Dipole Flattop	BDFTP-Dipole Feeder 52-213	18033

5.2.1.3 While wearing approved flash suit, and other personal protection equipment, and looking away from the panel, open the breaker contacts by pressing the trip button.

Warning:
Insure the breaker indicates it is in the Open position.

5.2.1.4 Using the hand crank, rack out the circuit breaker fully. Visually verify that the breaker is out to the disconnect position.

Warning:
If during this process there is any unusual mechanical binding or other unusual behavior, stop and call the line crew shift supervisor.

5.2.2 Kirk Key Removal

Turn the associated Kirk Key until the plunger is fully engaged in the hole in bar on the circuit breaker. Remove the Kirk Key from the lock. Attach a red tag to the breaker in accordance with BNL ES&H 1.5.1.

5.2.3 Secure Substation

i. Close enclosure
ii. Re-lock substation
iii. Return substation key to the technical supervisor.
iv. Prior to accessing any power supply enclosure verify that voltage is not present.

5.3 Removing LOTO on Substation

These steps must be performed on BOTH the flattop module and the ramp module associated with the power supply.

5.3.1 Kirk Key Installation

5.3.1.1 Insert the four Kirk keys for the power module door locks into the Kirk key transfer block (match the numbers on the keys with those on the cylinder), located on the back of the power module.

5.3.1.2 Remove the two Kirk keys from the transfer block that are used to unlock the circuit breakers of both power modules. It will not be possible to remove these keys unless all of the other four keys are in the transfer block.

5.3.2. Circuit Breaker Activation

5.3.2.1 Obtain key to substation gate.

i. The ‘Safety Watch’ rule applies in this procedure. One authorized person performs the procedure, and a second authorized person observes the procedure through the open door from outside the enclosure. The 'Safety Watch' is responsible for keeping unauthorized individuals out of the flash boundary.

ii. Approved flash suit, and other personal protection equipment, must be worn by the authorized person removing LOTO during the racking in procedure.

5.3.2.2 Identify breaker to be racked in.

Warning
Only breakers labeled for RHIC access are to be operated. Access to all other breakers is strictly forbidden.

Each Power Module has its own dedicated circuit breaker. Table 2 lists the power modules, the circuit breaker nomenclature, and the Kirk Key numbers associated with each power module.

5.3.2.3 Insert the Kirk Keys for the circuit breakers into the locks and turn the key until the plunger is fully retracted from the circuit breaker.

Warning 1:
If during this process there is any unusual mechanical binding or other unusual behavior, stop and call the line crew shift supervisor.

Warning 2:
Ensure the breaker indicates it is in the Open position before proceeding.

5.3.2.4 While wearing approved flash suit, and other personal protection equipment, use the hand crank and rack in the breaker. Visually verify that the indicator on the side of the breaker is in the CONNECTED position.

5.3.2.5 While wearing approved flash suit, and other personal protection equipment, turn the breaker handle to charge the spring and reset the mechanism.

5.3.2.6 While wearing approved flash suit, and other personal protection equipment, and looking away from the panel, close the breaker by pressing the close button.

5.4. Performing LOTO on Main Power Supplies for Access to OCC.

This paragraph must be performed before access to the OCC is permitted. This shuts off all sources of power to the OCC and disables the power modules.

5.4.1 Open and LOTO the switches labeled “CONTROL POWER” located on the front of the appropriate power modules, this applies to BOTH power modules associated with the OCC. DO NOT use a LOTO Safety Hasp (tree), attach a lock directly to the switch. If LOTO requires more than

one person to attach a lock, put the key from the lock on the switch in a lock box, and attach the Safety Hasp to the lock box. Additional locks can then be attached to the lock box.

5.4.2. Open and LOTO the circuit breakers according to Table 3. All the circuit breakers associated with a power supply MUST be opened and LOTO in accordance with ES&H 1.5.1. Verify the voltages are not present in the OCC.

5.5 Removing LOTO on Main Power Supplies after Access to OCC

5.5.1 Verify all panels on the OCC are installed and secure.

5.5.2 Remove LOTO from the switches in paragraph 5.4.1.

5.5.3 Remove LOTO from circuit breakers according to Table 3.

5.6 Performing LOTO on Main Power Supplies for Access to a Ring, Valve Box, or other Power Supplies on the Main Power Supply Circuit.

5.6.1 This step must be performed before access to a ring (where the buswork will be exposed), a valve box, or other power supplies on the main power supply circuit is permitted. This shuts off all sources of stored energy and disables the power modules.

- Open and LOTO, as per ES&H 1.5.1, the switches labeled "CONTROL POWER" located on the front of the appropriate power modules, this applies to BOTH power modules associated with the OCC. DO NOT use a LOTO Safety Hasp (tree), attach a lock directly to the switch. If LOTO requires more than one person to attach a lock, put the key from the lock on the switch in a lock box, and attach the Safety Hasp to the lock box. Additional locks can then be attached to the lock box.

5.7 Removing LOTO on Main Power Supplies after Access to a Ring, Valve Box, or other power supplies on the main power supply circuit.

5.7.1 Remove LOTO from the switches in paragraph 5.6.1

Table 3

Circuit Breakers for LOTO of Main Power Supplies

POWER SUPPLY		CIRCUIT BREAKER PANEL P4BRP4 CIRCUIT #	UPS CIRCUIT BREAKER #
Yellow Quad	OCC	17, 19, 21, 23	13
	RPM		10
	FTPM		12
Yellow Dipole	OCC	7, 9, 11, 13	15
	RPM		10
	FTPM		12
Blue Quad	OCC	16, 18, 20, 22	14
	RPM		9
	FTPM		11
Blue Dipole	OCC	2, 4, 6, 8	16
	RPM		9
	FTPM		11

6. Documentation

6.1 Power Supply Section (PSS) Activities Logbook

6.2 LOTO Logbook located in Building 1004B.

7. References

7.1 BNL ES&H STANDARD 1.5.1 Lockout/Tagout Requirements

8. Attachments

None